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INVESTIGATION OF THE APPLICATION OF HCMM THERMAL DATA TO SNOW HYDROLOGY

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1. INTRODUCTION

1.1 Objectives of Investigation

The objectives of the investigation of the application of HCMM thermal data to snow hydrology (HCMM Investigation No. 036) are as follows:

1) determine practical utility of HCMM thermal IR data to establish distribution of snow cover and determine accuracy of temperature measurements;

   a. determine accuracy of surface temperatures acquired through use of HCMM thermal IR measurements,

   b. detemine relative resolution utility between VHRR and HCMM for thermal IR measurements, and

   c. specifically delineate and quantify the problems involved with measuring snow temperature from space and relate them to present and planned earth observing satellite systems. This objective will take into consideration and utilize the capability of HCMM for day and night thermal measurements over appropriate sites and the satellite's eight-day repeat cycle;

2) determine if and how HCMM measurements can be factored in with Landsat data into an overall snow hydrology program related directly to snowmelt runoff prediction; and

3) develop an approach to automated data processing of combined visible and thermal infrared satellite acquired data to provide information of interest and use to the snow hydrologist.

1.2 Anticipated Results

The primary anticipated result of the proposed investigation is the development of improved techniques for the mapping and analysis of snow cover using spacecraft-acquired data. The results will provide an evaluation of the usefulness of high resolution thermal infrared data for

snow mapping and for input to snowmelt prediction programs; and will provide a better understanding of the relationships between the measured temperature values and such factors as type of snow, snow depth, type of terrain, and vegetation. The mapping and analysis techniques can then be applied to the automatic processing of data from future spacecraft systems, and will eventually enable snow survey, which is a vital part of water resources management, to be accomplished on a more cost-effective basis.

2. ACCOMPLISHMENTS DURING REPORTING PERIOD

All HCMM data needed for the investigation have now been received, including the imagery and CCT's for the April 1979 day/night registered data set for the Sierras study area. These data, however, were not received until late in the reporting period. With the receipt of the April data, three sets of excellent day/night registered data for the Sierras study area have now been received. Analysis of the earlier two day/night sets (late May and mid-July 1978) has been completed.

Initial examination of the newly received imagery indicates that the April 1979 data are the best quality HCMM day/night registered data of the three data sets. The thermal inertia imagery is particularly outstanding, appearing to contain much more detail and information than the earlier thermal inertia images. Moreover, we have U-2 data over the test area for 4 April and some surface truth measurements for 6 April (acquired from the University of California at Santa Barbara) to compare with the HCMM data.

3. PROBLEMS

Because of anticipated delays in receiving the final HCMM data products, a request for a one-month contract extension was submitted 12 September. The extension was granted, making the due date of the draft final report 23 October.

Under this existing contract schedule and remaining funds, it would not be possible to process the digital tape data and would be possible only to carry out a cursory analysis of the imagery for the April 1979

case. A request for an additional contract extension and additional funding was, therefore, submitted on 15 October. The additional time and funding would enable us to carry out a thorough analysis of the imagery and digital data, including an assessment of the application of the apparent thermal inertia patterns to snow hydrology.

4. PLANS FOR NEXT REPORTING PERIOD

All data analysis except for the April 1979 day/night registered data set has been completed, and the draft final report is in preparation. If the request for a contract extension and additional funding is approved, the April data set will be analyzed for inclusion in the final report. The draft report will be completed during the next reporting period.

Under the proposed additional effort, patterns in the day/night temperature difference and thermal inertia images would be mapped and compared with the patterns observed in the other cases and with ground-truth data. In addition, the values from the digital tape data would be analyzed for selected sub-areas with differing elevation, vegetation, and snow cover characteristics within the overall Sierras study area.

5. TRAVEL

No travel related to the project occurred during this reporting period.

6. PUBLICATIONS

No material related to this investigation was published during this reporting period.

7. SIGNIFICANT RESULTS

No new significant results were obtained during this reporting period.

8. FUNDS EXPENDED

Approximately 95 percent of the total available funds for the contract have been expended to date. If the request for additional funds is approved, we anticipate that the investigation can be completed meeting all originally proposed objectives.